FreedomCAR Partnership

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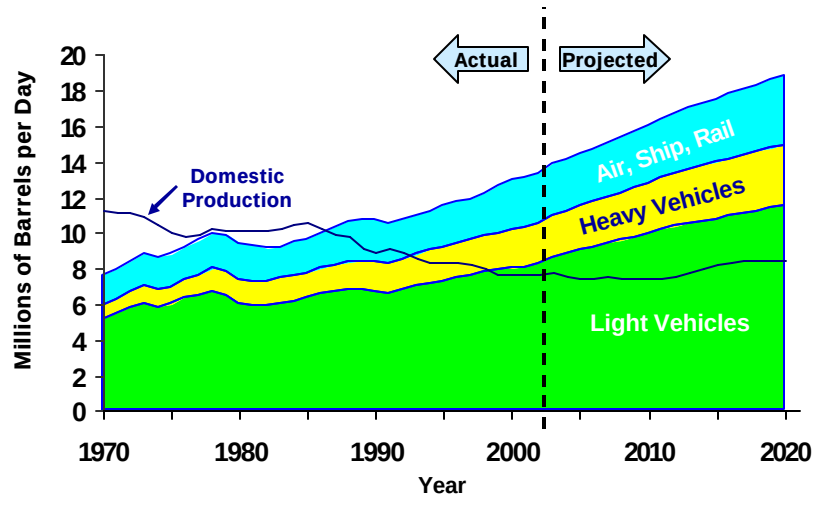
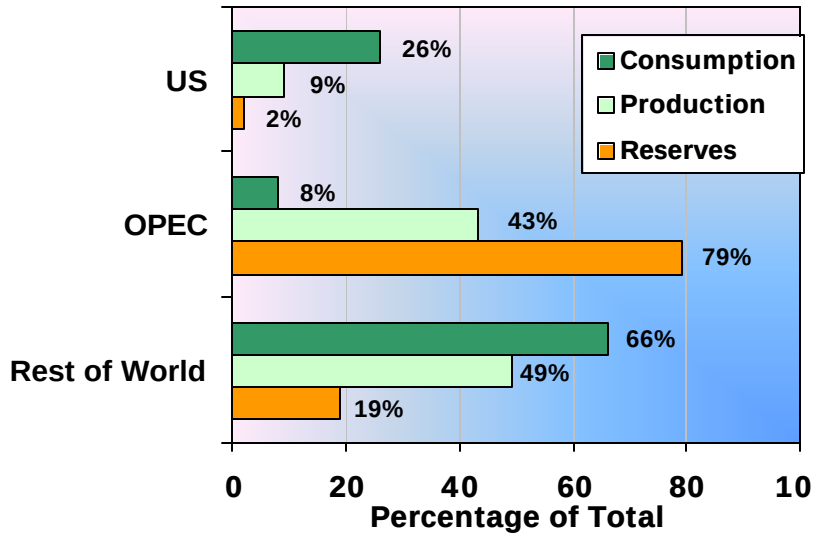
U.S. Transportation Demands More Oil



Source: Transportation Energy Data Book: Edition 21, DOE/ORNL-6966, September 2001, and EIA Annual Energy Outlook 2002 DOE/EIA-0383(2002), December 2001

1

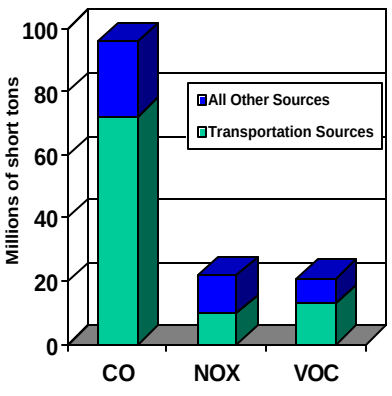
World Oil Reserves are Consolidating in OPEC Nations



3

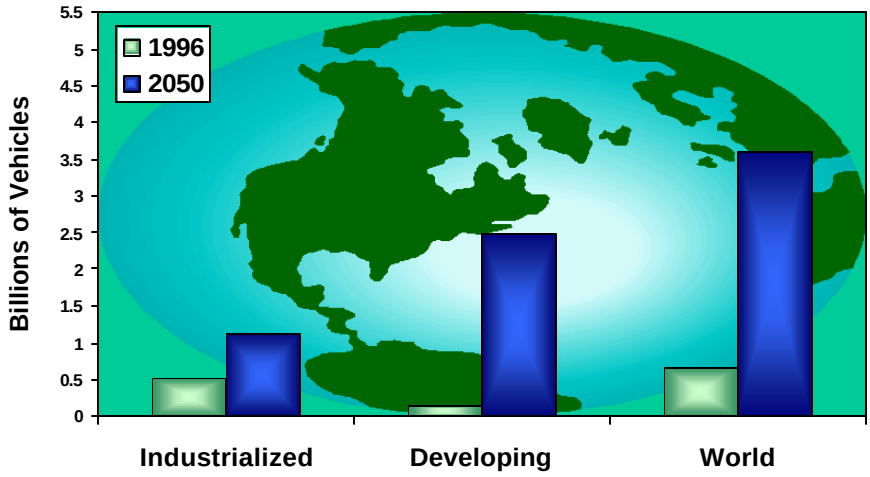
Transportation Emissions Remain a Concern in the United States and Internationally

- Transportation produces:
  - 79% of carbon monoxide,
  - 50% of nitrogen oxides,
  - 36% of volatile organics, and
  - 42% of carbon dioxide emissions.
- Over 100 million people live in areas not meeting National Ambient Air Quality Standard. (EPA, Oct. 1995)



4

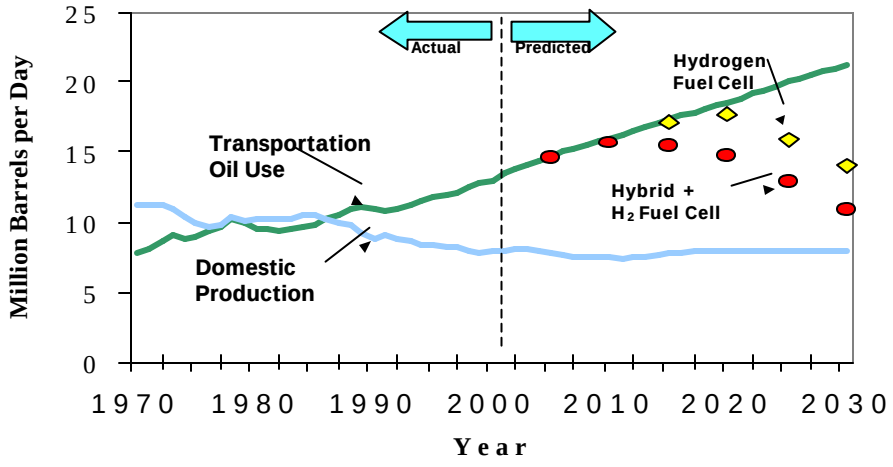
World Vehicle Registrations



Source: OTT Analysts

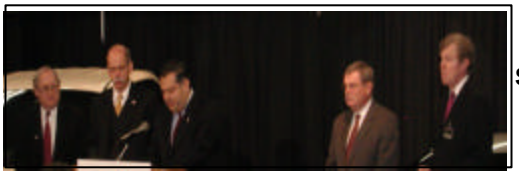
5

Closing the Oil Gap



6

FreedomCAR is a Partnership



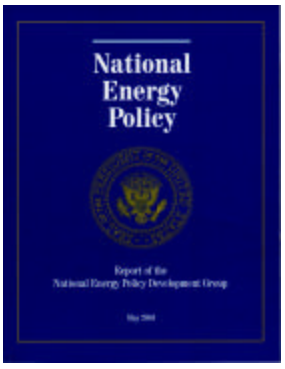
January 9, 2002
Secretary Abraham announces the FreedomCAR Partnership

- The CAR in FreedomCAR is for Cooperative Automotive Research
- The Partners are:
  - U.S. Department of Energy
  - U.S. Council for Automotive Research

(USCAR is a cooperative endeavor of DaimlerChrysler, Ford and General Motors to conduct pre-competitive research)

7

National Energy Policy



- "...that the President direct the Secretary of Energy to establish a national priority for improving energy efficiency. (Recommendation 4.14)
- "Increase funding for renewable energy and energy efficiency research and development programs that are performance-based and cost-shared." (page xii)
- "...Based on this review, the Secretary of Energy is then directed to propose appropriate funding of those research and development programs that are performance-based and modeled as public-private partnerships." (Recommendations 4.2 and 6.3)

8

Partnering is Key

FreedomCAR

California Fuel Cell Partnership — Driving for the Future

USABC

Government-Industry
21st Century Truck Partnership

US AMP

9

Strategic Approach

FreedomCAR

- **Develop technologies to enable mass production of affordable hydrogen-powered fuel cell vehicles and assure the hydrogen infrastructure to support them.**
- **Continue support for hybrid technologies and advanced materials that can dramatically reduce oil consumption and environmental impacts in the nearer term.**
- **Develop technologies applicable across a wide range of passenger vehicles.**

10

FC Vehicles and Hybrids Share Much Technology

FreedomCAR encompasses support for technologies with the potential to dramatically reduce oil consumption and environmental impacts in the period prior to the introduction of affordable fuel-cell vehicles:

- ✓ Hybrid Electric Drivetrains
- ✓ Advanced Internal Combustion Engines
- ✓ On-Board Fuel Processors for Fuel Cells
- ✓ Lightweight Materials, Energy Storage, Electronic Components

11

Goals

- Develop reliable systems for future fuel cell powertrains with costs and performance comparable to conventional internal combustion engine/automatic transmission systems.
- Enable clean, energy-efficient vehicles operating on clean, hydrocarbon-based fuels powered by either internal combustion powertrains or fuel cells.
- Enable reliable hybrid electric vehicles that are durable and affordable.

12

Goals

- **Enable the transition to a hydrogen economy, ensure widespread availability of hydrogen fuels while retaining the functional characteristics of current vehicles.**
- **Develop material manufacturing technologies for light weight, high volume production vehicles.**

2010 FreedomCAR Technology Specific Goals

	Efficiency	Power	Energy	Cost**	Life	Weight
Fuel Cell System	60% (hydrogen) 45% (w/ reformer)	325 W/kg 220 W/L		$45/kW (2010) $30kW (2015)		
Hydrogen Fuel/ Storage/ Infrastructure	70% well to pump		2 kW -h/kg 1.1 kW -h/L	$5/kW -h $1.25/gal (gas equiv.)		
Electric Propulsion		≥55 kW 18 s 30 kW cont.		$12/kW peak	15 years	
Electric Energy Storage		25 kW 18 s	300 W -h	$20/kW	15 years	
Materials						50% less
Engine Powertrain System*	45% peak			$30/kW	15 years	

* Meets or exceeds emissions standards.

** Cost references based on CY2001 dollar values.

FreedomCAR Organization

Executive Steering Committee

USCAR Vice Presidents of R&D

DOE EERE Assistant Secretary, OSTP Associate Director of Technology

Designated Observers – OVP, OMB

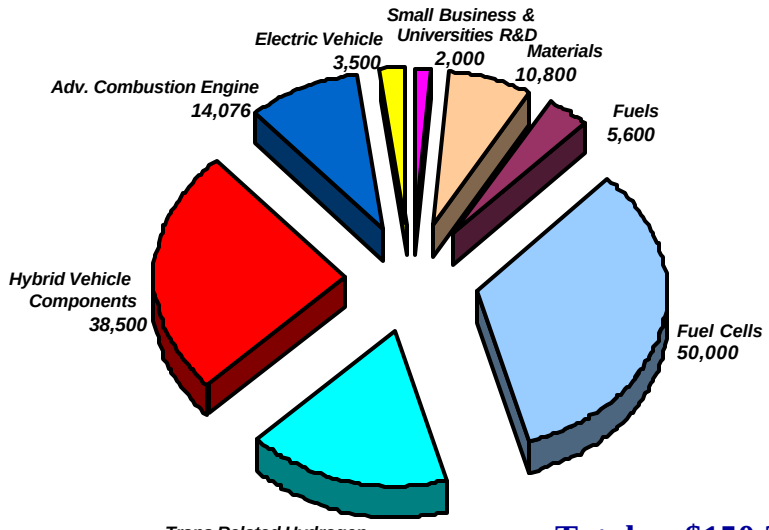
FreedomCAR Operations Group

Industry FreedomCAR Directors & USCAR Director

EERE FreedomCAR & Vehicle Technologies and Hydrogen & Infrastructure Program Directors and DOE FreedomCAR Partnership Director

- Hydrogen Storage & Vehicle Interface Tech Team
- Fuel Cell Tech Team
- Systems Engineering & Analysis Tech Team
- Materials Tech Team
- Battery Tech Team
- Electrical & Electronics Tech Team
- Advanced Combustion & Emission Control Tech Team
- Fuels Working Group

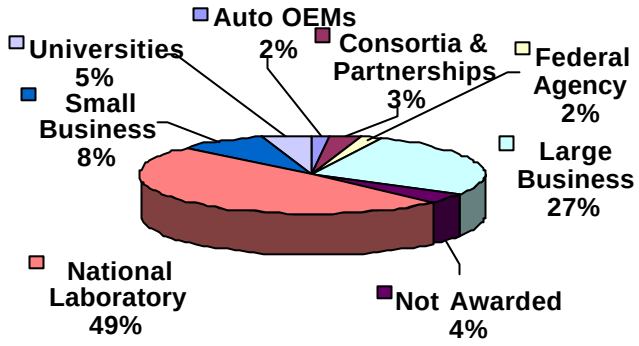
FreedomCAR FY03 Budget Request



($K)

Totals = $150,296

FreedomCAR FY 2002 Funding by Type of Recipient



17

FreedomCAR Partnership

A Long-Term Effort to Achieve

Clean Energy-Efficient Automotive Transportation

Based on Hydrogen-Powered Fuel-Cell Vehicles

With

✓ **Intermediate Goals and Metrics**

to Ensure Measurable Progress

While

✓ **Ensuring America's Transportation Freedoms**

18